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(54) **Detection of multiple articles**

Erfassung einer Vielzahl von Artikeln

Détection d'une pluralité d'articles

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Description

BACKGROUND OF THE INVENTION

This invention relates to an identification system comprising an interrogator and a plurality of transponders.

South African Patent application No. 92/0039 describes an identification system comprising an interrogator and a number of individual transponders which may be attached to or associated with articles to be identified. The articles to be identified may be, for example, items of stock in a supermarket or warehouse.

It is an object of the invention to increase the probability of transponder identification in a system of the kind referred to above.

PRIOR ART

EP 494114 A discloses an interrogator/transponder system in which an interrogator broadcasts an interrogation signal to a plurality of transponders present in the interrogation field. One example of the identification system comprises an interrogator or reader which transmits interrogation signals at a power of approximately 15W and at a frequency of approximately 915 MHZ to a number of passive transponders. The transponders derive a power supply from energy in the interrogation signal, and modulate a portion of the energy received from the interrogator with an identification code to generate a response signal, which is transmitted back to the interrogator.

GB 2152335 A discloses an inventory control which employs tags which resonate at the unique pair of frequencies and reradiate simultaneously at a third frequency. An interrogator sweeps stepwise through a programmed set of all the pertinent pairs frequencies to interrogate a plurality of tags and the receiver of the interrogator is tuned to the third frequency. The amplitude of third frequency is a function of distance, receiver antenna pattern and the number of tags present.

WO 8200910 A discloses an ultrasonic communication and security system. A plurality of Intrusion sensors can be interrogated from a central data unit by signals which are propagated at two different frequencies. The frequencies are sufficiently separated that the locations of nulls due to multipath propagation are spatially separate.

SUMMARY OF THE INVENTION

According to a first aspect of the invention there is provided an identification system comprising an interrogator and a plurality of transponders, the interrogator including transmitter means for transmitting an interrogation signal to the transponders, receiver means for receiving response signals from the transponders, and processor means for identifying the transponders from data in the response signals; each transponder comprising receiving means, a code generator, and transmitting means connected to the code generator, so that on receipt of the transmitted interrogation signal the transponder transmits a response signal containing data which identifies the transponder; the interrogator being adapted to disable any transponder, characterised in that the interrogator transmits at least two intermittent interrogation signals, with an interval between successive interrogation signals which is less than a minimum period within which transponders which have been disabled reset themselves automatically.

The at least two interrogation signals may have respective different frequencies which are selected to fall within the reception bandwidth of the receiving means of the transponders.

Preferably, the at least two interrogation signals are relatively narrow bandwidth signals, the receiving means of each transponder having a relatively broad reception bandwidth within which the respective different frequencies of the at least two interrogation signals fall, so that the transponder is responsive to one or more of the interrogation signals.

Preferably, each interrogation signal is modulated with data, the data modulation bandwidth of each interrogation signal being less than the spacing between the respective different frequencies of the interrogation signals.

The transmitting means of the transponder may comprise an antenna and means for modulating the reflectivity of the antenna, so that the response signal of the transponder comprises one or more interrogation signal carriers modulated with the data which identifies the transponder.

Preferably, the transmitter means of the interrogator comprises at least two spaced apart transmitting antennas and the receiver means comprises at least two spaced apart receiving antennas.

The transmitter means and the receiver means may comprises at least two spaced apart antenna units, each antenna unit comprising a transmitting antenna and an adjacent receiving antenna.

Each antenna may comprise a patch array designed to operate at a frequency between 800 MHz and 1 GHz.

Preferably, at least two of the respective transmitting and receiving antennas are polarized differently from one another.

The transmitter means and the receiver means of the interrogator may be mounted on or adjacent to a structure which defines an interrogation zone through which the transponders to be identified may be passed.

In a preferred embodiment, the transmitter means and the receiver means of the interrogation are supported by a frame defining a passage through which a conveyance containing articles to which respective transponders are attached can pass.

The respective different frequencies of the at least

two interrogation signals are preferably selected so that there are no overlapping nulls in the electric fields of the interrogation signals within a predetermined distance of the transmitter means of the interrogator.

The system may include processor means for recording data received from each identified transponder and for relating the received data to stored data corresponding to the received data.

The processor means may be adapted to store price or identification data of articles to which different transponders are attached, and to relate the identification codes of identified transponders thereto.

The system may include display means for generating a display in which the articles to which respective transponders are attached are associated with price data.

The system may further include printer means for generating a printout of the display.

According to another aspect of the invention there is provided interrogator for identifying a plurality of transponders comprising the interrogator, including transmitter means for transmitting an interrogation signal to the transponders, receiver means for receiving response signals from the transponders, and processor means for identifying the transponders from data in the response signals, the interrogator being adapted to disable any transponder, characterised in that the interrogator transmitter transmits at least two intermittent interrogation signals, with an interval between successive interrogation signals which is less than a minimum period within which transponders which have been disabled reset themselves automatically.

According to a third aspect of the invention there is provided a method of identifying a plurality of transponders comprising the steps of transmitting an interrogation signal to the transponders, each transponder receiving the interrogation and transmitting a signal, containing data, in response, receiving the response signals from the transponders, identifying transponders from data in the response signals, detecting successful identification of any transponder, disabling said any transponder; and characterised in that at least two intermittent interrogation signals are transmitted, with an interval between successive interrogation signals which is less than a minimum period within which transponders which have been disabled reset themselves automatically.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a diagram illustrating the creation of a null in an interrogation zone as a result of a reflected signal;

Figure 2 is a schematic diagram illustrating a first embodiment of the invention;

Figure 3 is a diagram illustrating the effect of using different frequencies for the interrogation signal;

Figure 4 is a schematic diagram of a second embodiment of the invention:

Figure 5 is a schematic illustration of a practical embodiment of the invention at a supermarket checkout;

Figure 6 is a pictorial view of an antenna assembly of the system of Figure 5;

Figure 7 is a plan view of an antenna unit of the antenna assembly of Figure 6;

Figure 8 is a graph showing the radiation pattern of an antenna element of the antenna unit Figure 7;

Figure 9 is a block schematic diagram showing the overall electronic circuitry of the system of Figures 5 and 6:

Figure 10 is a more detailed block schematic diagram of a quadrature receiver/amplifier of Figure 9;

Figure 11 is a waveform diagram showing waveforms at different points in Figure 10;

Figure 12 is a sample customer receipt printed by the system of Figures 5 and 6;

DESCRIPTION OF EMBODIMENTS

Figure 1 illustrates a problem which occurs in identification systems of the kind referred to when there is a reflecting surface close to the interrogator 10 and/or the interrogation zone in which it is desired to detect transponders. A primary interrogation signal 12 is transmitted directly from the antenna 14 of the interrogator 10 to the interrogation zone, while a secondary interrogation signal 16 is reflected from the reflecting surface. At certain distances from the interrogator. the direct and reflected signals 12 and 16 will be half a wavelength out of phase, causing nulls in the electric field of the interrogation signal. This results in zones 20 of the interrogation zone having a weak interrogation signal, with insufficient RF energy to power up the transponders. As a result of this, certain transponders may go undetected by the interrogator.

Figure 2 illustrates schematically a first solution to the problem. In Figure 2, the interrogator 10 is provided with first and second antennas 22 and 24, which are spaced one half wavelength apart, and which can be selected by means of switch means 26. Due to the different spacing of the antennas, the nulls or zones 20 of low power occur at different locations. In use, the interrogator 10 is first connected to the antenna 22 and scans articles in the interrogation zone, recording the identity codes received from the various transponders attached to the articles. The switch means 26 then connects the interrogator 10 to the antenna 24, and the process is repeated. The identification codes recorded during both interrogation procedures are compared, and duplicated codes are discarded. In this way, all of the articles in the interrogation zone can be identified, despite some of them lying in portions of the interrogation zone which are in an RF null of one of the antennas 22 or 24.

The above system is adequate for identifying articles which each have a transponder with a unique identification code. However, where a number of articles are provided with transponders all having the same identification code, it is not possible to count the number of articles accurately using the system of Figure 2, since it is not possible to compare the results of the first and second interrogation procedures in such a way as to discard duplicate readings.

The system described in South African patent application No. 92/0039, the contents of which are incorporated herein by reference, includes a number of identical transponders, which are attached to articles of the same kind, to allow automatic stocktaking. Each transponder is disabled after it has successfully communicated its presence to the interrogator, and remains in a disabled state until the RF field caused by the interrogation signal has been removed completely. Clearly, a system which has deep RF nulls in its interrogation zone would not be suitable for use with this type of tag, as individual tags might interpret the lack of RF power in a null as the turning off of the interrogator. As a result, a transponder which had been disabled after successful identification could be turned on again when the position of the null moves, providing an extra signal and thus causing an incorrect count.

In order to overcome this problem, an interrogator is provided which transmits interrogation signals at at least two different frequencies, intermittently. For example, frequencies at 750 MHz and 915 MHz can be employed. These frequencies are chosen so that there is no location within the interrogation zone where there is an RF null at both frequencies, as indicated in Figure 3. Since the transponders are powered by rectifying received RF energy from the interrogation signals, and as RF energy will be present at each location in the interrogation zone from at least one of the interrogation signals, the transponders will remain powered continuously, and will be able to remember a "disable instruction" received from the interrogator after successful identification.

The interval between successive transmissions must be less than the minimum period within which disabled transponders reset themselves automatically.

Since the transponders modulate their identity codes by either changing the reflectivity of their receiving antenna, or by reradiating a percentage of the received interrogation signal energy, modulated with the identification code, this data will be transferred on both frequencies for those tags which are illuminated by both interrogation signals simultaneously, and only on one frequency in the case of those transponders which are located in the null of one or the other interrogation signal. From this, the interrogator can recognise transponders responding on one or both frequencies.

A system for implementing this embodiment of the invention is illustrated schematically in Figure 4. In this system, the interrogator comprises an interrogator/controller unit 28, a first transmitter 30 with an associated antenna 32, and a second transmitter 34 with an associated antenna 36. Tags or transponders 38 are shown spaced about within an interrogation zone which is adjacent to a reflective surface 40. Nulls or areas of low RF field intensity 42 and 44 which are spaced apart from one another and do not overlap are shown schematically.

A number of practical applications of the present invention present themselves. In one application, the system is used in a supermarket to automate the check-out procedure, obviating the need for manual scanning or entry of prices using a cash register. In another application, the contents of a store room, warehouse or a truck, for example, can be determined without unloading or unpacking. In another application, articles such as books in a bookstore or library, or compact discs in a music store can be identified and counted, in an automated stock-taking process.

It will be appreciated that these examples are merely exemplary, and many other applications of the invention are possible.

A practical embodiment of the abovementioned supermarket check-out of the invention will now be described in more detail.

Figure 5 shows an interrogator according to the invention which is installed at a supermarket checkout, and which is designed to scan the contents of a supermarket trolley 46 which is passed through an antenna unit 48 of the interrogator. The interrogator includes a till or control unit 50 which has a keyboard or keypad 52, a display 54 and an invoice printer 56. The interrogator/control unit 50 is operated by a cashier or check-out assistant, as in a conventional supermarket.

The antenna assembly 48 of the interrogator is shown pictorially in Figure 6. and is seen to comprise a frame of welded tubular sections which supports three separate antenna units 58, 60 and 62.

The frame which supports the antenna units is sized so that the trolley 46 passes under the upper antenna unit 60 and between the left and right side antenna units 58 and 62, which are oriented to define an interrogation zone which is sufficiently large to cover the interior of the trolley as it is pushed past the antenna units. The antennas of the different antenna units are polarised differently from each other, to cater for the fact that articles in the interrogation zone may be oriented randomly, so that their transponder antennas will also be polarised randomly

Inside the trolley are various articles 64 which are groceries including bottles, boxes and other containers, as well as larger items which may not be contained in a box or other container, but which are identified by means of a tag, sticker or label, for example.

Each article 64 in the trolley 46 has a transponder embedded therein or attached thereto, which has an identification code uniquely identifying the type of article to which it is attached. Articles of the same type are fitted

with transponders having identical codes. A number of the articles in the trolley may be identical, and will therefore have transponders with identical codes.

The three antenna units 58, 60 and 62 operate at different frequencies. The left side antenna unit 58 operates at 915 MHz, the right side antenna unit 62 operates 910 MHz, and the upper antenna unit 60 operates at 920 MHz.

Each antenna unit 58, 60, 62 comprises a transmitting antenna and a receiving antenna. The transmitting and receiving antenna are identical. Each antenna is a microstrip patch array (see Figure 7) comprising four square patches 66 which are interconnected. The transmitting and receiving antennas are E-plane polarised and in the prototype installation were formed on Diclad type GY870 printed circuit board material, which has a copper cladding with a thickness of 3.2mm, and a substrate with a dielectric constant of 2.33 and a dissipation factor of 0.0012. The antenna patches 66 were 104 mm square, and each patch array was 406 mm square. Figure 8 is an E-plane radiation pattern for the microstrip patch array at 915 MHz, showing its relatively directional characteristics.

Figure 9 is an overall block diagram of the interrogator of the system, showing the antenna units, 58, 60 and 62 and their associated electronic circuitry. The transmitting antennas of each antenna unit 58, 60 and 62 are driven by respective transmitters 68, 70 and 72 which operate at centre frequencies of 910 MHz, 915 MHz and 920 MHz (that is, 5 MHz apart). The transmitters 68, 70 and 72 are controlled by transmitter control signals generated by a microprocessor-based control unit 74 which is linked to a central computer system or, in the present example, the till 50. The interrogation signals transmitted by each transmitter comprise a carrier signal (at the respective operating frequency of the transmitter) modulated by signals addressing particular transponders, particular groups or types of transponders, or all transponders.

The receiving antenna of each antenna unit 58, 60 and 62 is connected to a respective cavity tuned filter 76, 78, 80 which is tuned to the same frequency as the respective transmitter (that is, 910 MHz, 915 MHz or 920 MHz). The outputs of the filters 76, 78 and 80 are fed to respective quadrature receivers and amplifiers 82, 84, 86, together with signals from the respective transmitter which are derived from the local oscillator of the transmitter, and a 90° phase shifted version of the local oscillator signal. The respective quadrature receiver/amplifiers generate data output signals which are fed to a combiner circuit 88, which combines the data signals in a synchronised manner and which feeds a composite data signal to a phase locked loop and code extraction circuit 90, which extracts the codes contained in the received transponder signals and feeds them to the microprocessor 74.

The operation of the quadrature/receiver amplifiers 82, 84 and 86 is described below in greater detail with reference to Figure 10, which is a block diagram of a single quadrature receiver/amplifier, and Figure 11, which is a waveform diagram indicating the waveforms present at various points in the circuit of Figure 10.

The transmitters 68, 70 and 72, the cavity tuned filters 76, 78 and 80, the quadrature receiver amplifiers 82, 84 and 86, and other associated RF components are housed in the housings of the respective antenna units 58 60 and 62. The antenna units are connected to the combiner 88 and the microprocessor 74 in the housing of the till 50 by cables 64. The cables carry data between the antenna units and the control and processing circuitry of the interrogator, and also supply electrical power to the antenna units.

After being powered up by the received interrogation signals, the transponders attached to the articles 64 in the trolley 46 begin to respond, transmitting their own identification codes back to the interrogator by modulating the received interrogator carrier frequency, as described South African patent application no. 92/0039. Because each transponder is a relatively wide band device, and has an antenna which is typically designed to receive signals from 800 MHz to 1 GHz, the transponders can respond to one or more of the signals transmitted by the respective antenna units, at their different frequencies. The transmitters of the interrogator must, of course, transmit at frequencies within the reception bandwidth of the transponder (in this case, at frequencies between 800 MHz and 1 GHz).

The circuitry of the transponder is designed to change the effective input impedance of the transponder circuit when the transponder is transmitting its identification code at its onboard oscillator clock rate (typically 10 KHz), thereby changing the termination and reflectivity of the transponder antenna accordingly. Thus, a portion of the received interrogation signal is reflected back to the interrogator antenna, modulated with the transponder's own output signal. In this mode of operation, it is possible that the interrogation signal from the interrogator can be received by the transponder at one, two or all three different frequencies used by the respective antenna units 58, 60 and 62, and the transponder will reflect a modulated signal back to each antenna unit at the different respective frequencies. It makes no difference to the operation of the transponder whether it is illuminated by one or more different frequencies, and the reflected signals at the respective different frequencies do not interfere with one another, due to the relatively narrow bandwidth of the antenna units 58, 60 and 62 and their associated circuitry, and because the data modulation bandwidth of the interrogation signals is typically selected to be between 10 KHz and 100 KHz, substantially less than the spacing between the different interrogation frequencies.

A transponder response signal received by any of the antenna units is fed via the respective receiving antenna and its associated cavity tuned filter to a mixer/filter circuit 92 where the received signal is mixed with

a local oscillator signal obtained from the associated transmitter to extract the baseband transponder response signal. The mixer/filter circuit 92 includes a low pass filter to eliminate higher frequency products which result from different frequencies of adjacent interrogator transmitters. The output of the mixer/filter circuit 92 is a signal A (see Figure 11) which is fed to a high pass filter 94, where code transitions in the transponder response signal are extracted by means of pseudo-differentiation. The response signal is indicated at B in Figure 11.

The demodulated baseband transponder response signal A varies in strength as well as containing inherent low frequency noise due to the doppler shift of the interrogation signal carrier frequencies as objects movc in the interrogation zone. The high pass filter 94 filters out the low frequency noise, passing only the relatively high frequency transitions of the code and effectively amplifying the resulting "spikes". These transition "spikes" are further amplified by an amplifier circuit 96, resulting in the amplified signal C of Figure 11. The signal C is then passed through a full wave rectifier 98. The resulting full wave rectified signal is labelled D1. The received transponder response signal is passed through an identical receiver circuit. but the mixer/filter circuit 92' thereof is fed with a phase shifted version of the local oscillator signal which is 90° out of phase with the local oscillator signal fed to the mixer/filter circuit 92. The output of the duplicate receiver circuit is a full wave rectified signal D2.

The outputs of the full wave rectifier circuits 98 and 98' are added together in a summing circuit 100 to generate a composite waveform E. Where transitions or "spikes" occur together, the summed output is relatively large, while where only one weak signal occurs the summed output is relatively small. The purpose of the dual receiver arrangement is to deal with the situation where a received signal is not detected due to the received signal being exactly in phase with the local oscillator reference signal from the transmitter. By using an additional phase shifted local oscillator signal in a duplicate receiver channel, at least one of the signals D1 or D2 will generate a strong output from a received signal.

The output of the summing circuit 100 is fed to an amplifier 102, which feeds the amplified combined signal to a noise limiter circuiter 104 which is set to generate output clock pulses when it receives input pulses above a reference threshold. These clock pulses are fed to a D-type flip-flop 106 which generates an output F, which is the received Manchester code format signal received from the transponder. The codes of the transponder response signals are so arranged that the first bit of a transponder message is always a Manchester "1", which corresponds with the format of the codes which are regenerated by the flip-flop 106.

In the waveform diagram of Figure 11, the waveforms D1 and D2 correspond to signals received from a transponder which are slightly different in amplitude. When summed together to produce signal E, the "spikes" of the signals D1 and D2 are added to become relatively strong signals. If the signals are sufficiently large in amplitude to exceed a threshold 108 of the noise limiter circuit 104, a Manchester code output transition F is generated.

Each of the antenna units and its respective transmitter and receiver circuitry operates similarly, so that each of the quadrature receiver/amplifiers 82. 84 and 86 can pick up a response signal from a transponder, using its own interrogation frequency and its own antenna polarisations.

In this regard, the situation can arise that articles which are placed in the trolley 46 have transponders with antennas which are polarised differently, due to being tossed in the trolley into a random manner. In the case of articles packed in a truck or a storeroom, the articles might be packed in a consistent manner, but the antennas of the transponders on the articles might be horizontally polarised, whereas a single interrogator antenna might be vertically polarised and would therefore not "see" the transponders. However, in the illustrated arrangement, the use of three different operating frequencies, together with differently polarised antennas, ensures that the transponders within the trolley are generally illuminated by at least two different interrogation frequencies simultaneously, if not all three.

Metallic objects such as tin cans within the trolley can partially screen the trolley contents from one of the antenna units. However, in most cases the other two antenna units will normally illuminate the transponders in question. If the polarisation of one of these antenna units is incorrect for the transponder in question, the remaining antenna unit should detect the transponder. Obviously, it is conceivable that the situation could arise where a transponder was completely shielded from all three of the antenna units. However, this is unlikely in practice. In situations where it is vital to identify all of the articles in an interrogation zone, further antenna units could be provided.

In the example described above, for example, a further antenna unit could be provided below the trolley, either in addition to or instead of the upper antenna unit. The antenna assembly could define a bay in which the trolley is temporarily "parked". instead of a "tunnel" through which the trolley is pushed. This would facilitate placing a further antenna unit at the inner end of the bay.

The Manchester code data which is generated by each quadrature receiver/amplifier 82, 84 and 86 is fed to a combiner circuit 88 which comprises a circuit which adds the three incoming waveforms in an analogue style to form a single combined response signal. The circuit is followed by a comparator and a single flip-flop for regenerating a single Manchester code as described previously. The output of the combiner circuit 88 is therefore a Manchester code containing 64 bits of information and always starting with a "1".

The output of the combiner circuit is fed to the phase

locked loop circuit 90 and to the microprocessor 74, which extracts the information from the received code as described in South African patent application no. 93/6267. The microprocessor extracts the transponder identification code from the received signal, verifies that the code is a valid number by means of parity checking or CRC checking, and processes the number according to the relevant application.

If the microprocessor 74 decides that a transponder has been validly identified, the appropriate transmitters 68, 70 and 72 is instructed to modify its respective interrogation signals, for example by interrupting the output signals completely or by reducing their output power by a predetermined amount a certain time after successful reception of the transponder response signal. This process is carried out in accordance with the system described in South African patent application no. 93/6267, the contents of which are incorporated herein by reference.

Frequently, the transmissions from individual transponders will be "jammed" by overlapping transmissions from other transponders, so that the received signals will not pass one or other of the checking/verification steps. However, when a transponder signal is received during a "quiet" period when other transponders are not transmitting simultaneously, it will be verified, and the resulting data is fed to the microprocessor 74 for identification and counting of the article to which the transponder is attached.

The above described system exploits the fact that low cost transponders of the kind in question use wide tolerance components, which allow good yields in manufacture. These transponders do not include tuned circuits and comprise a single integrated circuit produced in a conventional integrated circuit foundry. The antenna of the transponder determines its frequency response characteristics, and can be designed for a relatively wide bandwidth. These transponders can then be interrogated on several different frequencies, using relatively narrow bandwidth interrogator transmit/receive antennas, so that the transponders modulate several interrogation signals when transmitting a response.

When all of the transponders in the trolley 46 have been successfully identified. which can typically take less than one second, the microprocessor 74 passes the data to the till 50, which generates a print out which can take the form of the sample print out shown in Figure 12, by associating the received transponder codes with information in a price look-up table. The nature of each article in the trolley is indicated, as well as the price per article, the number of articles, the subtotal, and the total price of all the articles in the trolley. The microprocessor 74 or the till 50 itself can store the price look-up data, which can be updated periodically, for example daily. Alternatively, the microprocessor 74 or the till 50 can be connected online to a central computer, which provides updated price look-up data on an ongoing basis.

The information in the sample print out of Figure 12 can be displayed on the screen 54 of the till 50, and is reflected on a paper print out generated by the printer 56. which serves as the customer's receipt. Payment can be made by the customer in a conventional manner. However, the automatic generation of a receipt by the described system lends itself to automatic billing of clients who have an account with the retailer in question.

Claims

1. An identification system comprising an interrogator and a plurality of transponders,

   the interrogator including transmitter means for transmitting an interrogation signal to the transponders, receiver means for receiving response signals from the transponders, and processor means for identifying the transponders from data in the response signals;
   each transponder comprising receiving means, a code generator, and transmitting means connected to the code generator, so that on receipt of the transmitted interrogation signal the transponder transmits a response signal containing data which identifies the transponder;
   the interrogator being adapted to disable any transponder,

   characterised in that the interrogator transmits at least two intermittent interrogation signals, with an interval between successive interrogation signals which is less than a minimum period within which transponders which have been disabled reset themselves automatically.

2. An identification system according to claim 1 wherein the at least two interrogation signals have respective different frequencies which are selected to fall within the reception bandwidth of the receiving means of the transponders.

3. An identification system according to claim 2 wherein the at least two interrogation signals are relatively narrow bandwidth signals, the receiving means of each transponder having a relatively broad reception bandwidth within which the respective different frequencies of the at least two interrogation signals fall, so that the transponder is responsive to any one or more of the interrogation signals.

4. An identification system according to claim 3 wherein each interrogation signal is modulated with data, the data modulation bandwidth of each interrogation signal being less than the spacing between the respective different frequencies of the interrogation signals.

5. An identification system according to any one of claims 1 to 4 wherein the transmitting means of the transponder comprises an antenna and means for modulating the reflectivity of the antenna, so that the response signal of the transponder comprises one or more interrogation signal carriers modulated with the data which identifies the transponder.

6. An identification system according to any one of claim 1 to 5 wherein the transmitter means of the interrogator comprises at least two spaced apart transmitting antenna elements and the receiver means comprises at least two spaced apart receiving antenna elements.

7. An identification system according to any one of claim 1 to 5 wherein the transmitter means and the receiver means comprise at least two spaced apart antenna units, each antenna unit comprising a transmitting antenna element and an adjacent receiving antenna element.

8. An identification system according to claims 6 or 7 wherein each antenna element comprises a patch array designed to operate at a frequency between 800 MHz and 1 GHz.

9. An identification system according to any one of claims 6 to 8 wherein at least two of the respective transmitting and receiving antenna elements are polarized differently from one another.

10. An identification system according to any one of claims 1 to 9 wherein the transmitting means of the interrogator comprises a transmitting antenna element, at least first and second transmitters for generating interrogation signals at respective different frequencies, and switch means for switching the outputs of the transmitters alternately to the transmitting antenna element.

11. An identification system according to any one of claims 1 to 10 wherein the transmitter means and the receiver means of the interrogator are mounted on or adjacent to a structure which defines an interrogation zone through which the transponders to be identified may be passed.

12. An identification system according to claim 11 wherein the transmitter means and the receiver means of the interrogation are supported by a frame defining a passage through which a conveyance containing articles to which respective transponders are attached can pass.

13. An identification system according to any one of claims 1 to 12 wherein the at least two interrogation signals have respective different frequencies which are selected so that there are no overlapping nulls in the electric fields of the interrogation signals within a predetermined distance of the transmitter means of the interrogator.

14. An identification system according to any one of claims 1 to 13 including processor means for recording data received from each identified transponder and for relating the received data to stored data corresponding to the received data.

15. An identification system according to claim 14 wherein the processor means is adapted to store price or identification data of articles to which different transponders are attached, and to relate the identification codes of identified transponders thereto.

16. An identification system according to claim 15 including display means for generating a display in which descriptions of the articles to which respective transponders are attached are associated with price data.

17. An identification system according to claim 16 including printer means for generating a printout of the display.

18. An interrogator for identifying a plurality of transponders comprising

the interrogator including transmitter means for transmitting an interrogation signal to the transponders, receiver means for receiving response signals from the transponders, and processor means for identifying the transponders from data in the response signals,
the interrogator being adapted to disable any transponder,

characterised in that the interrogator transmitter transmits at least two intermittent interrogation signals, with an interval between successive interrogation signals which is less than a minimum period within which transponders which have been disabled reset themselves automatically.

19. An interrogator according to claim 18 wherein the at least two interrogation signals have respective different frequencies.

20. An interrogator according to claim 19 wherein the at least two interrogation signals are relatively narrow bandwidth signals.

21. An interrogator according to claim 20 wherein each interrogation signal is modulated with data, the data modulation bandwidth of each interrogation signal

being less than the spacing between the respective different frequencies of the interrogation signals.

22. An interrogator according to any one of claim 18 to 21 wherein the transmitter means of the interrogator comprises at least two spaced apart transmitting antenna elements and the receiver means comprises at least two spaced apart receiving antenna elements.

23. An interrogator according to any one of claim 18 to 21 wherein the transmitter means and the receiver means comprise at least two spaced apart antenna units, each antenna unit comprising a transmitting antenna element and an adjacent receiving antenna element.

24. An interrogator according to claims 22 or 23 wherein each antenna element comprises a patch array designed to operate at a frequency between 800 MHz and 1 GHz.

25. An interrogator according to any one of claims 22 to 24 wherein at least two of the respective transmitting and receiving antenna elements are polarized differently from one another.

26. An interrogator according to any one of claims 18 to 25 wherein the transmitting means of the interrogator comprises a transmitting antenna element, at least first and second transmitters for generating interrogation signals at respective different frequencies, and switch means for switching the outputs of the transmitters alternately to the transmitting antenna element.

27. An interrogator according to any one of claims 18 to 26 wherein the transmitter means and the receiver means of the interrogator are mounted on or adjacent to a structure which defines an interrogation zone.

28. An interrogator according to claim 27 wherein the transmitter means and the receiver means of the interrogation are supported by a frame defining a passage through which a conveyance containing articles can pass.

29. An interrogator according to any one of claims 18 to 28 wherein the at least two interrogation signals have respective different frequencies which are selected so that there are no overlapping nulls in the electric fields of the interrogation signals within a predetermined distance of the transmitter means of the interrogator.

30. A method of identifying a plurality of transponders comprising the steps of

transmitting an interrogation signal to the transponders,
each transponder receiving the interrogation and transmitting a signal. containing data, in response,
receiving the response signals from the transponders,
identifying transponders from data in the response signals,
detecting successful identification of any transponder.
disabling said any transponder; and

characterised in that at least two intermittent interrogation signals are transmitted, with an interval between successive interrogation signals which is less than a minimum period within which transponders which have been disabled reset themselves automatically.

31. A method according to claim 30 wherein the respective different frequencies of the at least two interrogation signals are selected to fall within the reception bandwidth of the transponders.

32. A method according to claim 31 wherein the at least two interrogation signals have a relatively narrow bandwidth and the transponders have a relatively broad reception bandwidth within which the respective different frequencies of the at least two interrogation signals fall.

33. A method according to claim 32 wherein each interrogation signal is modulated with data, the data modulation bandwidth of each interrogation signal being less than the spacing between the respective different frequencies of the interrogation signals.

34. A method according to any one of claims 30 to 33 wherein the response signal from a transponder comprises one or more interrogation signal carriers modulated with the data which identifies said transponder.

35. A method according to any one of claims 30 to 34 which includes switching between interrogation signals.

36. A method according to any one of claims 30 to 35 wherein the at least two interrogation signals have respective different frequencies which are selected so that there are no overlapping nulls in the electric fields of the interrogation signals within a predetermined distance of the transmitter means of the interrogator.

37. A method according to any one of claims 30 to 36 including recording data received from each identi-

fied transponder and relating the received data to stored data corresponding to the received data.

38. A method according to claim 37 wherein the price or identification data of articles to which different transponders are attached are stored, and the identification codes of identified transponders are related thereto.

39. A method according to claim 38 including displaying descriptions of the articles to which respective transponders are attached and associating said articles with price data.

40. A method according to claim 39 including printing a printout of the display.

Patentansprüche

1. Identifizierungssystem umfassend ein Abfragegerät und eine Mehrzahl von Antwortgeräten,

- wobei das Abfragegerät eine Sendereinrichtung zum Senden eines Abfragesignals an die Antwortgeräte, eine Empfängereinrichtung zum Empfangen von Antwortsignalen von den Antwortgeräten und eine Verarbeitungseinrichtung zum Identifizieren der Antwortgeräte aufgrund der Daten in den Antwortsignalen umfaßt,
- wobei jedes Antwortgerät Empfangseinrichtungen, einen Codeerzeuger sowie Sendeeinrichtungen umfaßt, welche mit dem Codeerzeuger verbunden sind, so daß bei Erhalt des gesendeten Abfragesignals das Antwortgerät ein Antwortsignal sendet, das Daten enthält, die das Antwortgerät identifizieren,
- wobei das Abfragegerät jedes Antwortgerät sperren kann, dadurch gekennzeichnet, daß das Abfragegerät zumindest zwei intermittierende Abfragesignale sendet, wobei ein Intervall zwischen aufeinanderfolgenden Abfragesignalen vorhanden ist, das kürzer als ein Mindestzeitraum ist, in dem Antwortgeräte, die gesperrt wurden, sich selbst automatisch zurückstellen können.

2. Identifizierungssystem nach Anspruch 1, wobei die zumindest zwei Abfragesignale jeweils unterschiedliche Frequenzen aufweisen, die so gewählt sind, daß sie in die Empfangsbandbreite der Empfangseinrichtungen der Antwortgeräte fallen.

3. Identifizierungssystem nach Anspruch 2, wobei die zumindest zwei Abfragesignale Signale mit relativ schmaler Bandbreite sind, die Empfangseinrichtungen jedes Antwortgeräts eine relativ breite Empfangsbandbreite aufweisen, in welche die jeweils unterschiedlichen Frequenzen der zumindest zwei Abfragesignale fallen, so daß das Antwortgerät auf jedes einzelne oder mehrere Abfragesignale reagiert.

4. Identifizierungssystem nach Anspruch 3, wobei jedes Abfragesignal mit Daten moduliert ist, wobei die Datenmodulationsbandbreite jedes Abfragesignals geringer als der Abstand zwischen den jeweils unterschiedlichen Frequenzen der Abfragesignale ist.

5. Identifizierungssystem nach einem der Ansprüche 1 bis 4, wobei die Sendereinrichtung des Antwortgeräts eine Antenne und Einrichtungen zum Modulieren des Reflexionsvermögens der Antenne umfaßt, so daß das Antwortsignal des Antwortgeräts einen oder mehrere Abfragesignalträger umfaßt, die mit den Daten, die das Antwortgerät identifizieren, moduliert sind.

6. Identifizierungssystem nach einem der Ansprüche 1 bis 5, wobei die Sendereinrichtung des Abfragegeräts zumindest zwei voneinander beabstandete Sendeantennenelemente und die Empfängereinrichtung zumindest zwei voneinander beabstandete Empfangsantennenelemente umfaßt.

7. Identifizierungssystem nach einem der Ansprüche 1 bis 5, wobei die Sendereinrichtung und die Empfängereinrichtung zumindest zwei voneinander beabstandete Antenneneinheiten umfassen, wobei jede Antenneneinheit ein Sendeantennenelement und ein benachbartes Empfangsantennenelement umfaßt.

8. Identifizierungssystem nach einem der Ansprüche 6 oder 7, wobei jedes Antennenelement eine Schaltanordnung umfaßt, die dafür ausgelegt ist, bei einer Frequenz von zwischen 800 MHz und 1 GHz zu arbeiten.

9. Identifizierungssystem nach einem der Ansprüche 6 bis 8, wobei zumindest zwei der jeweiligen Sende- und Empfangsantennenelemente unterschiedlich voneinander polarisiert sind.

10. Identifizierungssystem nach einem der Ansprüche 1 bis 9, wobei die Sendeeinrichtung des Abfragegeräts ein Sendeantennenelement, zumindest einen ersten und einen zweiten Sender zum Erzeugen von Abfragesignalen mit jeweils unterschiedlichen Fre-

quenzen sowie Schalteinrichtungen zum Schalten der Ausgangssignale der Sender alternativ zum Sendeantennenelement umfaßt.

11. Identifizierungssystem nach einem der Ansprüche 1 bis 10, wobei die Sendereinrichtung und die Empfängereinrichtung des Abfragegeräts auf oder benachbart zu einer Struktur montiert sind, die einen Abfragebereich definiert, durch den die zu identifizierenden Antwortgeräte hindurchgeführt werden können.

12. Identifizierungssystem nach Anspruch 11, wobei die Sendereinrichtung und die Empfängereinrichtung der Abfrageeinrichtung durch einen Rahmen abgestützt werden, der einen Durchgang definiert, durch den ein Transport von Artikeln, an denen die jeweiligen Antwortgeräte befestigt sind, stattfinden kann.

13. Identifizierungssystem nach einem der Ansprüche 1 bis 12, wobei die zumindest zwei Abfragesignale jeweils unterschiedliche Frequenzen aufweisen, die so gewählt sind, daß keine sich überschneidenden, toten Punkte in den elektrischen Feldern der Abfragesignale innerhalb eines vorgegebenen Abstands der Sendereinrichtung des Abfragegeräts vorhanden sind.

14. Identifizierungssystem nach einem der Ansprüche 1 bis 13, umfassend eine Verarbeitungseinrichtung zum Aufzeichnen von Daten, die von jedem identifizierten Antwortgerät empfangen wurden, und zum Inbeziehungsetzen der empfangenen Daten zu gespeicherten Daten, welche den empfangenen Daten entsprechen.

15. Identifizierungssystem nach Anspruch 14, wobei die Verarbeitungseinrichtung dafür ausgelegt ist, Preis- oder Identifizierungsdaten von Artikeln zu speichern, an denen die verschiedenen Antwortgeräte befestigt sind, und die Identifizierungscodes der identifizierten Antwortgeräte zu ihnen in Beziehung zu setzen.

16. Identifizierungssystem nach Anspruch 15, umfassend Anzeigeeinrichtungen zum Erzeugen einer Anzeige, in der Beschreibungen der Artikel, an denen die jeweiligen Antwortgeräte befestigt sind, Preisdaten zugeordnet werden.

17. Identifizierungssystem nach Anspruch 16, umfassend Druckereinrichtungen zum Erzeugen eines Ausdrucks der Anzeige.

18. Abfragegerät zum Identifizieren einer Mehrzahl von Antwortgeräten umfassend:

- das Abfragegerät, das Sendereinrichtungen zum Senden eines Abfragesignals an die Antwortgeräte, Empfängereinrichtungen zum Empfangen von Antwortsignalen von den Antwortgeräten sowie Verarbeitungseinrichtungen zum Identifizieren der Antwortgeräte aufgrund der Daten in dem Antwortsignal aufweist,
- wobei das Abfragegerät jedes Antwortgerät sperren kann, dadurch gekennzeichnet, daß der Abfragesender zumindest zwei intermittierende Abfragesignale sendet, wobei ein Intervall zwischen aufeinanderfolgenden Abfragesignalen vorhanden ist, das kürzer als ein Mindestzeitraum ist, in dem Antwortgeräte, die gesperrt wurden, sich selbst automatisch zurückstellen können.

19. Abfragegerät nach Anspruch 18, wobei die zumindest zwei Abfragesignale jeweils unterschiedliche Frequenzen aufweisen.

20. Abfragegerät nach Anspruch 19, wobei die zumindest zwei Abfragesignale Signale mit relativ schmaler Bandbreite sind.

21. Abfragegerät nach Anspruch 20, wobei jedes Abfragesignal mit Daten moduliert ist, wobei die Datenmodulationsbandbreite jedes Abfragesignals geringer als der Abstand zwischen den jeweils unterschiedlichen Frequenzen der Abfragesignale ist.

22. Abfragegerät nach einem der Ansprüche 18 bis 21, wobei die Sendereinrichtung des Abfragegerät zumindest zwei voneinander beabstandete Sendeantennenelemente und die Empfängereinrichtung zumindest zwei voneinander beabstandete Empfangsantennenelemente umfaßt.

23. Abfragegerät nach einem der Ansprüche 18 bis 21, wobei die Sendereinrichtung und die Empfängereinrichtung zumindest zwei voneinander beabstandete Antenneneinheiten umfassen, wobei jede Antenneneinheit ein Sendeantennenelement und ein benachbartes Empfangsantennenelement umfaßt.

24. Abfragegerät nach einem der Ansprüche 22 bis 23, wobei jedes Antennenelement eine Schaltanordnung umfaßt, die dafür ausgelegt ist, bei einer Frequenz von zwischen 800 MHz und 1 GHz zu arbeiten.

25. Abfragegerät nach einem der Ansprüche 22 bis 24, wobei zumindest zwei der jeweiligen Sende- und Empfangsantennenelemente unterschiedlich voneinander polarisiert sind.

26. Abfragegerät nach einem der Ansprüche 18 bis 25, wobei die Sendeeinrichtung des Abfragegeräts ein Sendeantennenelement, zumindest einen ersten und einen zweiten Sender zum Erzeugen von Abfragesignalen mit jeweils unterschiedlichen Frequenzen sowie Schalteinrichtungen zum Schalten der Ausgangssignale der Sender alternativ zum Sendeantennenelement umfaßt.

27. Abfragegerät nach einem der Ansprüche 18 bis 26, wobei die Sendereinrichtung und die Empfängereinrichtung des Abfragegeräts auf oder benachbart zu einer Struktur montiert sind, die einen Abfragebereich definiert.

28. Abfragegerät nach Anspruch 27, wobei die Sendereinrichtung und die Empfängereinrichtung der Abfrageeinrichtung durch einen Rahmen abgestützt werden, der einen Durchgang definiert, durch den ein Transport von Artikeln stattfinden kann.

29. Abfragegerät nach einem der Ansprüche 18 bis 28, wobei die zumindest zwei Abfragesignale jeweils unterschiedliche Frequenzen aufweisen, die so gewählt sind, daß keine sich überschneidenden, toten Punkte in den elektrischen Feldern der Abfragesignale innerhalb eines vorgegebenen Abstands der Sendereinrichtung des Abfragegeräts vorhanden sind.

30. Verfahren zum Identifizieren einer Mehrzahl von Antwortgeräten umfassend die folgenden Schritte:

- Senden eines Abfragesignals an die Antwortgeräte,
- wobei jedes Antwortgerät, das die Abfrage empfängt, als Reaktion ein Signal, das Daten enthält, sendet,
- Empfangen des Antwortsignals von den Antwortgeräten,
- Identifizieren der Antwortgeräte aufgrund der Daten in dem Antwortsignal,
- Ermitteln einer erfolgreichen Identifizierung eines Antwortgeräts,
- Sperren des Antwortgeräts, und

dadurch gekennzeichnet, daß zumindest zwei intermittierende Abfragesignale gesendet werden, wobei ein Intervall zwischen aufeinanderfolgenden Abfragesignalen vorhanden ist, das kürzer als ein Mindestzeitraum ist, in dem Antwortgeräte, die gesperrt wurden, sich selbst automatisch zurückstellen können.

31. Verfahren nach Anspruch 30, wobei die jeweils unterschiedlichen Frequenzen der zumindest zwei Abfragesignale so gewählt sind, daß sie in die Empfangsbandbreite der Antwortgeräte fallen.

32. Verfahren nach Anspruch 31, wobei die zumindest zwei Abfragesignale eine relativ schmale Bandbreite und die Antwortgeräte eine relativ breite Empfangsbandbreite aufweisen, in welche die jeweils unterschiedlichen Frequenzen der zumindest zwei Abfragesignale fallen.

33. Verfahren nach Anspruch 32, wobei jedes Abfragesignal mit Daten moduliert ist, wobei die Datenmodulationsbandbreite jedes Abfragesignals geringer als der Abstand zwischen den jeweils unterschiedlichen Frequenzen der Abfragesignale ist.

34. Verfahren nach einem der Ansprüche 30 bis 33, wobei das Antwortsignal von einem Antwortgerät einen oder mehrere Abfragesignalträger umfaßt, die mit den Daten, die das Antwortgerät identifizieren, moduliert sind.

35. Verfahren nach einem der Ansprüche 30 bis 34, das das Schalten zwischen Abfragesignalen umfaßt.

36. Verfahren nach einem der Ansprüche 30 bis 35, wobei die zumindest zwei Abfragesignale jeweils unterschiedliche Frequenzen aufweisen, die so gewählt sind, daß keine sich überschneidenden, toten Punkte in den elektrischen Feldern der Abfragesignale innerhalb eines vorgegebenen Abstands der Sendereinrichtung des Abfragegeräts vorhanden sind.

37. Verfahren nach einem der Ansprüche 30 bis 36, umfassend das Aufzeichnen von Daten, die von jedem identifizierten Antwortgerät empfangen wurden, und das Inbeziehungsetzen der empfangenen Daten zu gespeicherten Daten, welche den empfangenen Daten entsprechen.

38. Verfahren nach Anspruch 37, wobei die Preis- oder Identifizierungsdaten von Artikeln, an denen verschiedene Antwortgeräte befestigt sind, gespeichert und die Identifizierungscodes der identifizierten Antwortgeräte zu ihnen in Beziehung gesetzt werden.

39. Verfahren nach Anspruch 38, umfassend das Anzeigen von Beschreibungen der Artikel, an denen die jeweiligen Antwortgeräte befestigt sind, und Zuordnen der Artikel zu Preisdaten.

40. Verfahren nach Anspruch 39, umfassend das Drucken eines Ausdrucks der Anzeige.

Revendications

1. Système d'identification comportant un interrogateur et une pluralité de transpondeurs,

   l'interrogateur incluant des moyens formant émetteur pour émettre un signal d'interrogation vers les transpondeurs, des moyens formant récepteur pour recevoir des signaux réponse en provenance des transpondeurs, et des moyens formant processeur pour identifier les transpondeurs à partir de données contenues dans les signaux réponse ;
   chaque transpondeur comportant des moyens de réception, un générateur de code et des moyens d'émission reliés au générateur de code, de sorte que, lorsqu'est reçu le signal d'interrogation émis, le transpondeur émet un signal réponse contenant des données qui identifient le transpondeur ;
   l'interrogateur étant adapté pour désactiver n'importe quel transpondeur,

   caractérisé en ce que l'interrogateur émet au moins deux signaux d'interrogation intermittents, avec un intervalle entre les signaux d'interrogation successifs qui est inférieur à la période minimale que mettent les transpondeurs qui ont été désactivés pour se réinitialiser automatiquement.

2. Système d'identification selon la revendication 1, dans lequel les au moins deux signaux d'interrogation ont des fréquences respectives différentes qui sont sélectionnées pour tomber dans la bande de réception des moyens de réception des transpondeurs.

3. Système d'identification selon la revendication 2, dans lequel les au moins deux signaux d'interrogation sont des signaux de largeur de bande relativement étroite, les moyens de réception de chaque transpondeur ayant une bande de réception relativement large dans laquelle tombent les fréquences respectives différentes des au moins deux signaux d'interrogation, de sorte que le transpondeur est sensible à l'un quelconque ou plusieurs des signaux d'interrogation.

4. Système d'identification selon la revendication 3, dans lequel chaque signal d'interrogation est modulé avec des données, la largeur de bande de modulation des données de chaque signal d'interrogation étant inférieure à l'espacement qui existe entre les fréquences respectives différentes des signaux d'interrogation.

5. Système d'identification selon l'une quelconque des revendications 1 à 4, dans lequel les moyens d'émission du transpondeur comportent une antenne et des moyens pour moduler la réflectivité de l'antenne, de sorte que le signal réponse du transpondeur comprenne une ou plusieurs porteuses de signal d'interrogation modulée(s) avec les données qui identifient le transpondeur.

6. Système d'identification selon l'une quelconque des revendications 1 à 5, dans lequel les moyens formant émetteur de l'interrogateur comportent au moins deux éléments formant antenne émettrice mutuellement espacés et les moyens formant récepteur comportent au moins deux éléments formant antenne réceptrice mutuellement espacés.

7. Système d'identification selon l'une quelconque des revendications 1 à 5, dans lequel les moyens formant émetteur et les moyens formant récepteur comportent au moins deux ensembles d'antennes mutuellement espacés, chaque ensemble d'antennes comportant un élément formant antenne émettrice et un élément formant antenne réceptrice adjacent.

8. Système d'identification selon la revendication 6 ou 7, dans lequel chaque élément formant antenne comprend un réseau de connexions conçu pour fonctionner à une fréquence comprise entre 800 MHz et 1 GHz.

9. Système d'identification selon l'une quelconque des revendications 6 à 8, dans lequel au moins deux des éléments formant antenne émettrice et réceptrice respectifs sont polarisés différemment.

10. Système d'identification selon l'une quelconque des revendications 1 à 9, dans lequel les moyens d'émission de l'interrogateur comportent un élément formant antenne émettrice, au moins des premier et second émetteurs pour générer des signaux d'interrogation à des fréquences respectives différentes, et des moyens de commutation pour commuter les sorties des émetteurs, d'une manière alternée, sur l'élément formant antenne émettrice.

11. Système d'identification selon l'une quelconque des revendications 1 à 10, dans lequel les moyens formant émetteur et les moyens formant récepteur de l'interrogateur sont montés sur une structure qui définit une zone d'interrogation à travers laquelle il est possible de faire passer les transpondeurs à identifier, ou sont montés adjacents à cette structure.

12. Système d'identification selon la revendication 11, dans lequel les moyens formant émetteur et les moyens formant récepteur de l'interrogateur sont supportés par un portique définissant un passage

à travers lequel il est possible de faire passer un élément de transport contenant des articles auxquels sont attachés les transpondeurs respectifs.

13. Système d'identification selon l'une quelconque des revendications 1 à 12, dans lequel les au moins deux signaux d'interrogation ont des fréquences respectives différentes qui sont sélectionnées de sorte que les champs électriques des signaux d'interrogation ne s'annulent jamais lorsqu'ils se superposent à moins d'une distance prédéterminée des moyens formant émetteur de l'interrogateur.

14. Système d'identification selon l'une quelconque des revendications 1 à 13, comportant des moyens formant processeur pour enregistrer les données reçues en provenance de chaque transpondeur identifié et rattacher les données reçues à des données mémorisées correspondant aux données reçues.

15. Système d'identification selon la revendication 14, dans lequel les moyens formant processeur sont adaptés pour mémoriser des données de prix ou d'identification d'articles auxquels sont attachés des transpondeurs différents, et pour leur rattacher les codes d'identification des transpondeurs identifiés.

16. Système d'identification selon la revendication 15, comportant des moyens formant affichage pour générer un affichage dans lequel des descriptions des articles auxquels sont attachés les transpondeurs respectifs sont associées à des données de prix.

17. Système d'identification selon la revendication 16, comportant des moyens formant imprimante pour générer une version imprimée de l'affichage.

18. Interrogateur pour identifier une pluralité de transpondeurs,

l'interrogateur comportant des moyens formant émetteur pour émettre un signal d'interrogation vers les transpondeurs, des moyens formant récepteur pour recevoir des signaux réponse en provenance des transpondeurs, et des moyens formant processeur pour identifier les transpondeurs à partir de données contenues dans les signaux réponse,
l'interrogateur étant adapté pour désactiver n'importe quel transpondeur,

caractérisé en ce que l'émetteur de l'interrogateur émet au moins deux signaux d'interrogation intermittents, avec un intervalle entre les signaux d'interrogation successifs qui est inférieur à la période minimale que mettent les transpondeurs qui ont été désactivés pour se réinitialiser automatiquement.

19. Interrogateur selon la revendication 18, dans lequel les au moins deux signaux d'interrogation ont des fréquences respectives différentes.

20. Interrogateur selon la revendication 19, dans lequel les au moins deux signaux d'interrogation sont des signaux qui ont une largeur de bande relativement étroite.

21. Interrogateur selon la revendication 20, dans lequel chaque signal d'interrogation est modulé avec des données, la largeur de bande de modulation des données de chaque signal d'interrogation étant inférieure à l'espacement qui existe entre les fréquences respectives différentes des signaux d'interrogation.

22. Interrogateur selon l'une quelconque des revendications 18 à 21, dans lequel les moyens formant émetteur de l'interrogateur comportent au moins deux éléments formant antenne émettrice mutuellement espacés et les moyens formant récepteur comportent au moins deux éléments formant antenne réceptrice mutuellement espacés.

23. Interrogateur selon l'une quelconque des revendications 18 à 21, dans lequel les moyens formant émetteur et les moyens formant récepteur comportent au moins deux ensembles d'antennes mutuellement espacés, chaque ensemble d'antennes comportant un élément formant antenne émettrice et un élément formant antenne réceptrice adjacent.

24. Interrogateur selon la revendication 22 ou 23, dans lequel chaque élément formant antenne comprend un réseau de connexions conçu pour fonctionner à une fréquence comprise entre 800 MHz et 1 GHz.

25. Interrogateur selon l'une quelconque des revendications 22 à 24, dans lequel au moins deux des éléments formant antennes émettrice et réceptrice respectifs sont polarisés différemment.

26. Interrogateur selon l'une quelconque des revendications 18 à 25, dans lequel les moyens d'émission de l'interrogateur comportent un élément formant antenne réceptrice, au moins un premier et un second émetteur pour générer des signaux d'interrogation à des fréquences respectives différentes, et des moyens formant commutateur pour commuter les sorties des émetteurs, d'une manière alternée, sur l'élément formant antenne émettrice.

27. Interrogateur selon l'une quelconque des revendications 18 à 26, dans lequel les moyens formant

émetteur et les moyens formant récepteur de l'interrogateur sont montés sur une structure qui définit une zone d'interrogation ou sont montés adjacents à cette structure.

28. Interrogateur selon la revendication 27, dans lequel les moyens formant émetteur et les moyens formant récepteur de l'interrogateur sont supportés par un portique définissant un passage à travers lequel peut passer un élément de transport contenant des articles.

29. Interrogateur selon l'une quelconque des revendications 18 à 28, dans lequel les au moins deux signaux d'interrogation ont des fréquences respectives différentes qui sont sélectionnées de sorte que les champs électriques des signaux d'interrogation ne s'annulent jamais lorsqu'ils se superposent à moins d'une distance prédéterminée des moyens formant émetteur de l'interrogateur.

30. Procédé pour identifier une pluralité de transpondeurs, comportant les étapes consistant à

émettre un signal d'interrogation vers les transpondeurs,
chaque transpondeur recevant le signal d'interrogation et émettant un signal, contenant des données, en réponse,
recevoir les signaux réponse en provenance des transpondeurs,
identifier des transpondeurs à partir de données contenues dans les signaux réponse,
détecter une identification réussie d'un transpondeur quelconque,
désactiver ledit transpondeur quelconque ; et

caractérisé en ce que au moins deux signaux d'interrogation intermittents sont émis, avec un intervalle entre les signaux d'interrogation successifs qui est inférieur à la période minimale que mettent les transpondeurs qui ont été désactivés pour se réinitialiser automatiquement.

31. Procédé selon la revendication 30, dans lequel les fréquences respectives différentes des au moins deux signaux d'interrogation sont sélectionnées pour tomber dans la bande de réception des transpondeurs.

32. Procédé selon la revendication 31, dans lequel les au moins deux signaux d'interrogation ont une largeur de bande relativement étroite et les transpondeurs ont une bande de réception relativement large dans laquelle tombent les fréquences respectives différentes des au moins deux signaux d'interrogation.

33. Procédé selon la revendication 32, dans lequel chaque signal d'interrogation est modulé avec des données, la largeur de bande de modulation des données de chaque signal d'interrogation étant inférieure à l'espacement qui existe entre les fréquences respectives différentes des signaux d'interrogation.

34. Procédé selon l'une quelconque des revendications 30 à 33, dans lequel le signal réponse en provenance d'un transpondeur comporte une ou plusieurs porteuses de signal d'interrogation modulée(s) avec les données qui identifient ledit transpondeur.

35. Procédé selon l'une quelconque des revendications 30 à 34, lequel inclut une commutation entre signaux d'interrogation.

36. Procédé selon l'une quelconque des revendications 30 à 35, dans lequel les au moins deux signaux d'interrogation ont des fréquences respectives différentes qui sont sélectionnées de sorte que les champs électriques des signaux d'interrogation ne s'annulent jamais lorsqu'ils se superposent à moins d'une distance prédéterminée des moyens formant émetteur de l'interrogateur.

37. Procédé selon l'une quelconque des revendications 30 à 36, incluant l'enregistrement des données reçues en provenance de chaque transpondeur identifié et le rattachement des données reçues à des données mémorisées correspondant aux données reçues.

38. Procédé selon la revendication 37, dans lequel les données de prix ou d'identification d'articles auxquels différents transpondeurs sont attachés sont mémorisées, et les codes d'identification des transpondeurs identifiés leur sont rattachés.

39. Procédé selon la revendication 38, comportant l'affichage de descriptions des articles auxquels des transpondeurs respectifs sont attachés et l'association desdits articles à des données de prix.

40. Procédé selon la revendication 39, comportant l'impression d'une version imprimée de l'affichage.

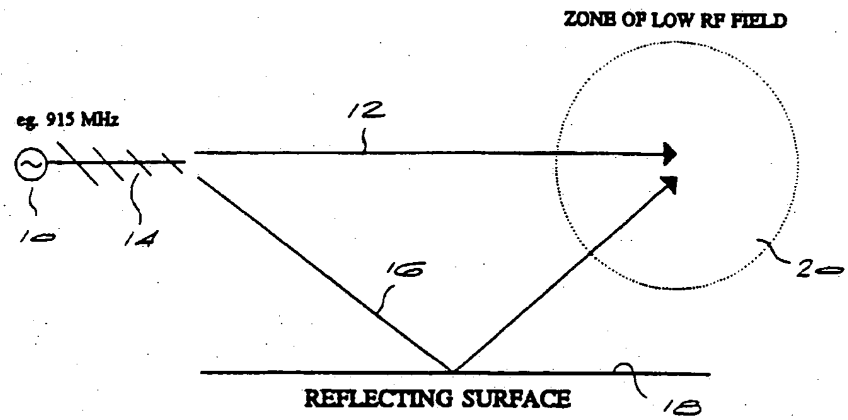


Figure 1.

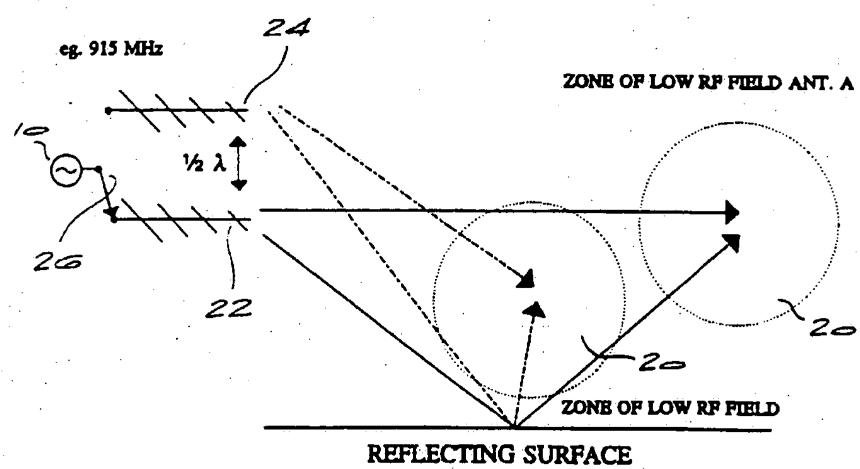


Figure 2.

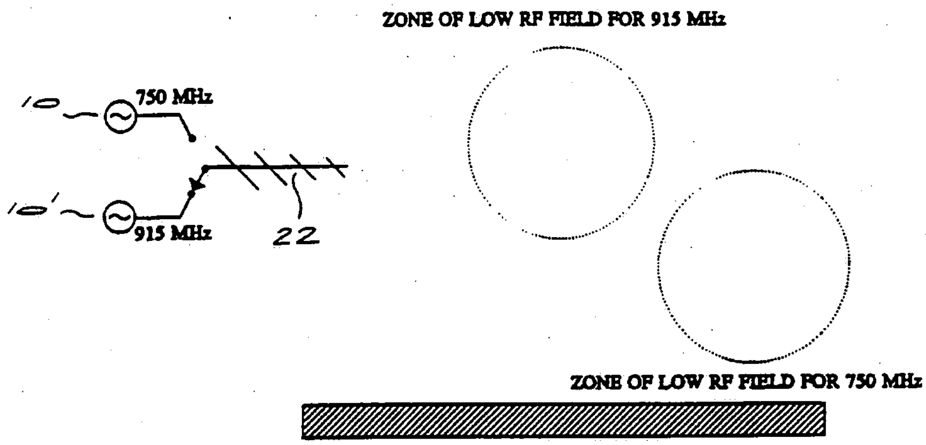


Figure 3.

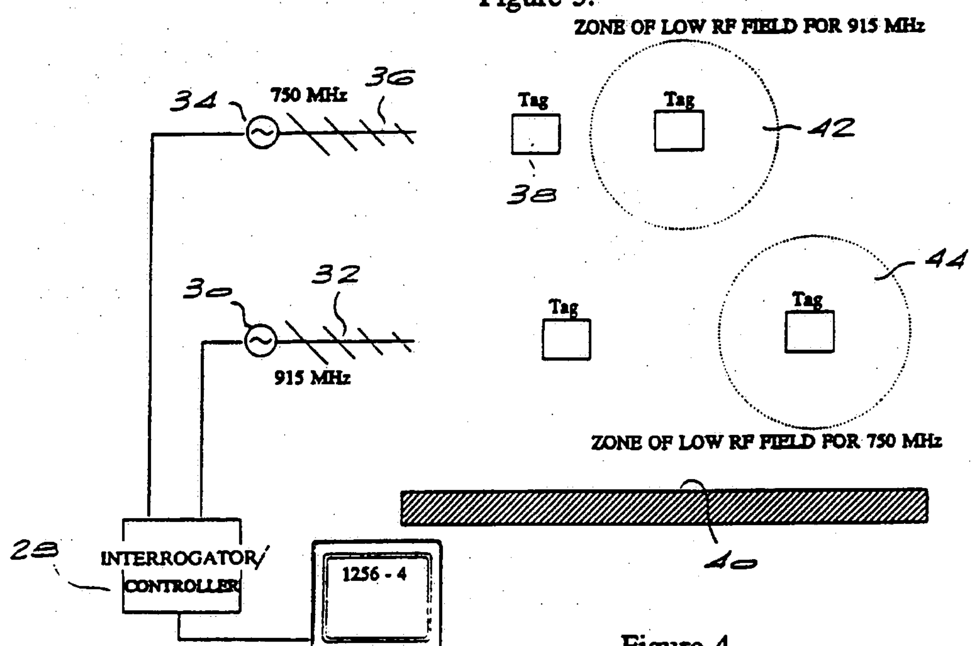


Figure 4.

FIG 5

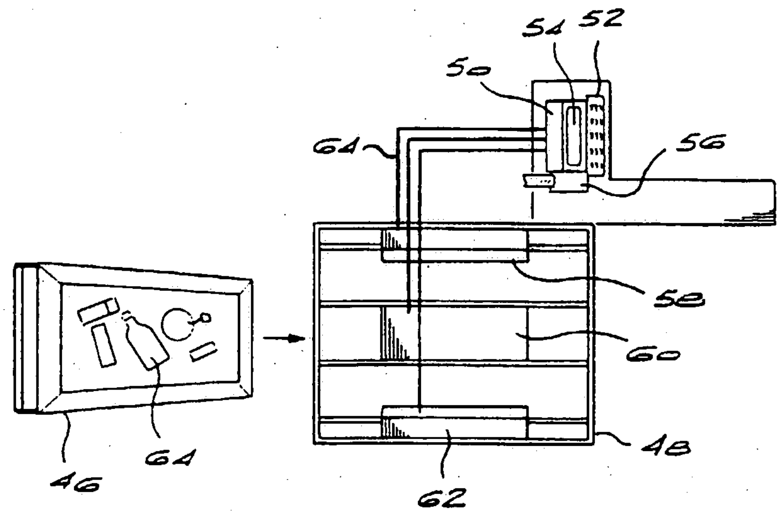


FIG 6

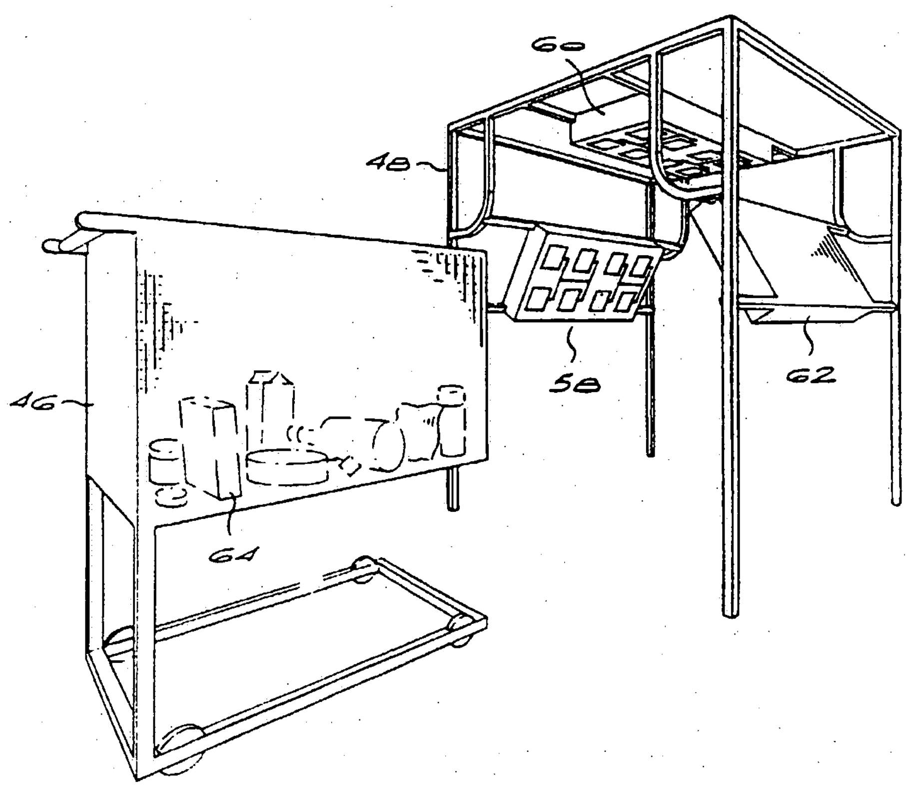


FIG. 7

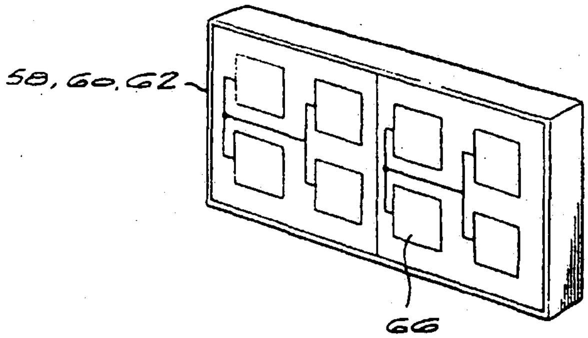
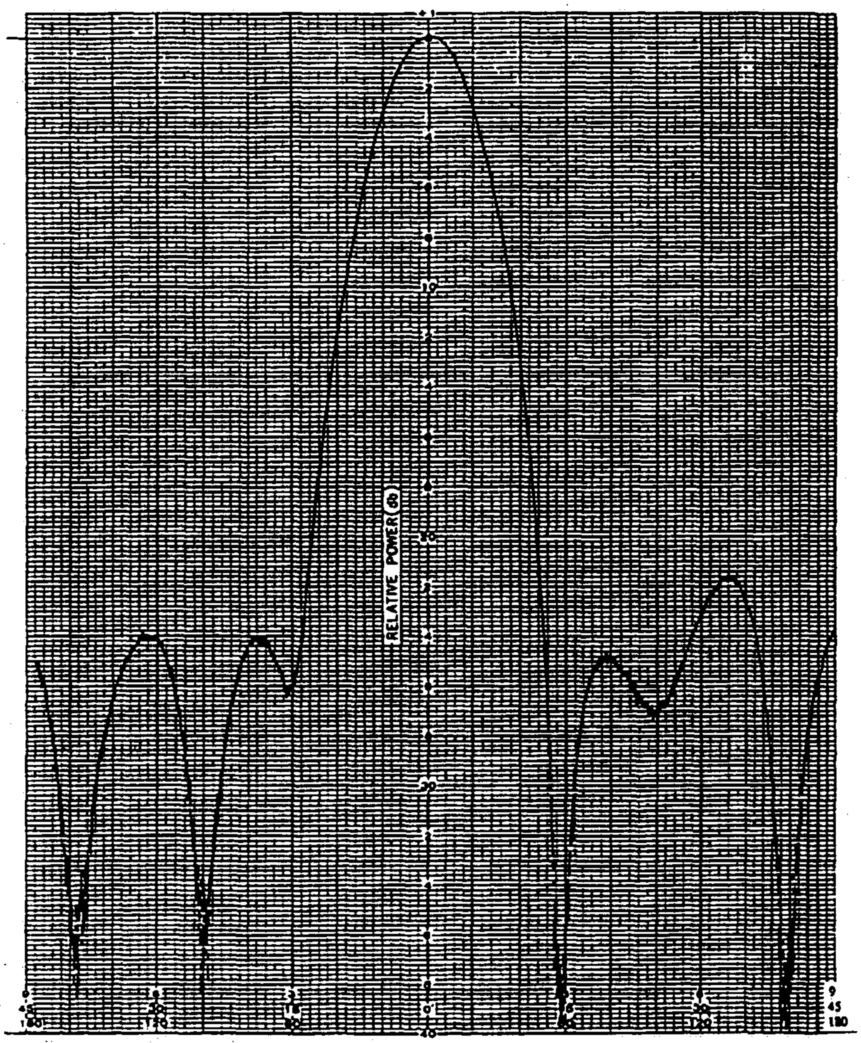


FIG. 8



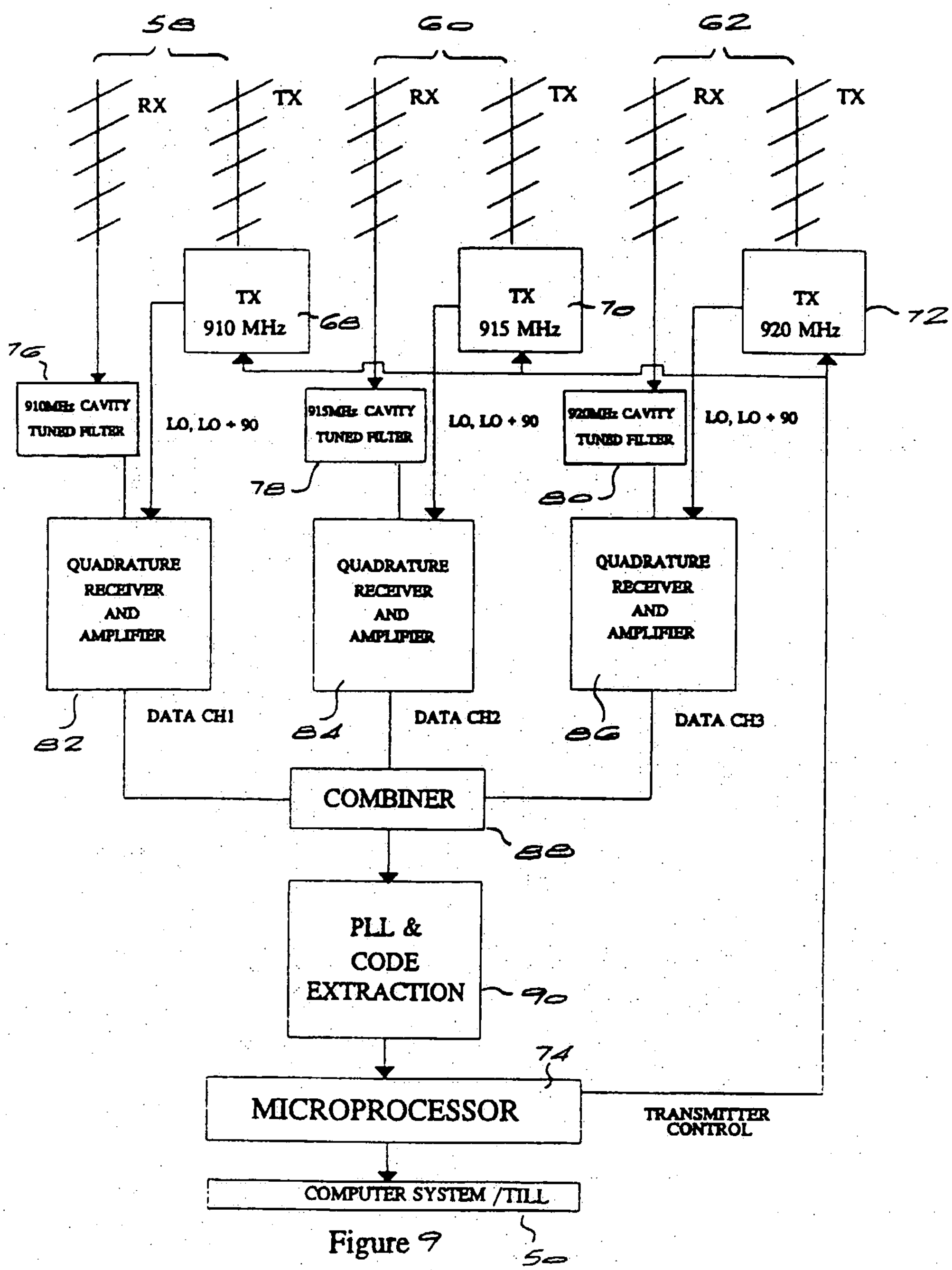

58
60
62
RX
TX
RX
TX
RX
TX
TX
910 MHz
68
TX
915 MHz
70
TX
920 MHz
72
76
910MHz CAVITY
TUNED FILTER
LO, LO + 90
915MHz CAVITY
TUNED FILTER
78
LO, LO + 90
920MHz CAVITY
TUNED FILTER
80
LO, LO + 90
QUADRATURE
RECEIVER
AND
AMPLIFIER
QUADRATURE
RECEIVER
AND
AMPLIFIER
QUADRATURE
RECEIVER
AND
AMPLIFIER
82
DATA CH1
84
DATA CH2
86
DATA CH3
COMBINER
88
PLL &
CODE
EXTRACTION
90
74
MICROPROCESSOR
TRANSMITTER
CONTROL
COMPUTER SYSTEM /TILL
50

Figure 9

FIG 10

Quadrature Receiver / Amplifier

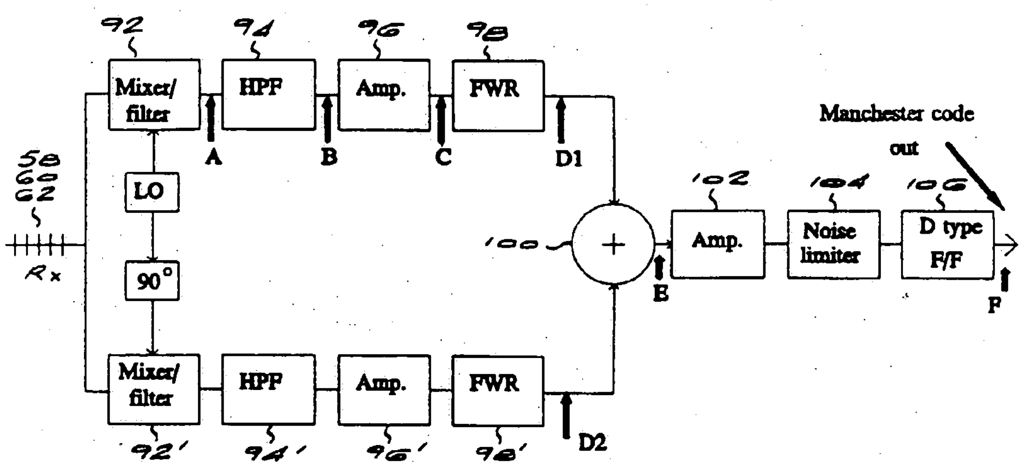


FIG 11

Quadrature receiver waveforms

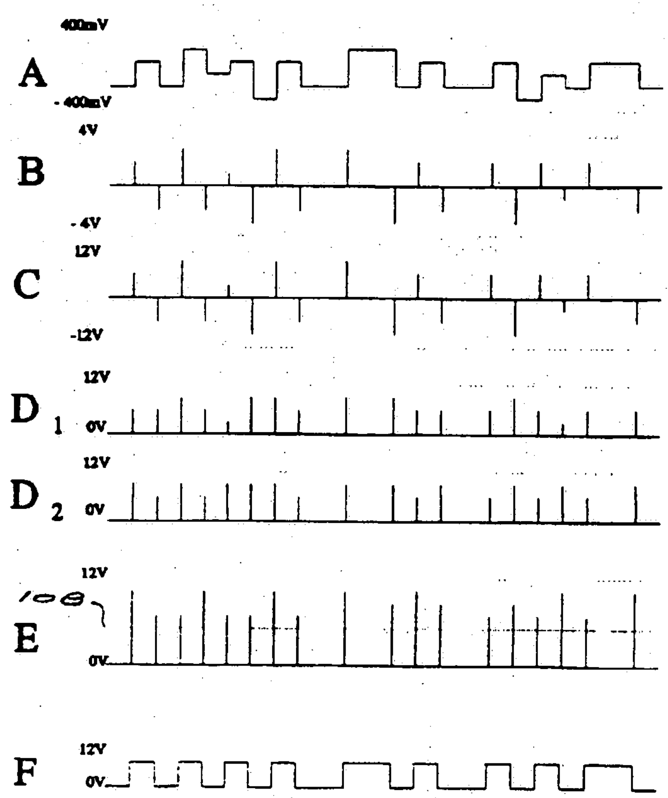


FIG 12

ABC SUPERMARKET

CUSTOMER RECEIPT

Tue Oct 12 1993 14:15

Romany Creams (200g)	@ R 2.99	x 4	R 11.96
Outspan Rusks (500g)	@ R 4.76	x 2	R 9.52
Kelloggs Cornflakes (300g)	@ R 4.34	x 3	R 13.02
Weetbix (900g)	@ R 6.99	x 3	R 20.97
Coffee Creamer (500g)	@ R 6.99	x 2	R 13.98
Kelloggs Variety Pack	@ R10.59	x 2	R 21.18
Lunch Wrap (10m x 300mm)	@ R 1.71	x 4	R 6.84
Carlton Towels (120 x 2ply sheets)	@ R 2.99	x 4	R 11.96
Mentadent-P (100ml)	@ R 3.59	x 1	R 3.59
	Total Items:	25	Total: R 113.02

HAVE A GOOD DAY - CALL AGAIN!